



PATENT

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NEW APPLICATION TRANSMITTAL

Transmitted herewith for filing is the patent application of

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for

**System and Method for Time-Shifted Program Viewing**

The application consists of ten pages of specification including ten claims, a declaration and power of attorney signed by the inventor. three copies of three sheets of drawings. and a check in payment of the filing fcc

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Respectfully submitted.

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## CERTIFICATION

I hereby certify that this New Application Transmittal and the documents referred to as enclosed therein are being deposited with the United States Postal Service on 6 May 1998 in an envelope as "Express Mail Post Office to Addressee", mailing label number EE578338449US addressed to the Commissioner of Patents and Trademarks, Washington, D.C. 20231.

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- 1. Application with Declaration
- 2. Drawings (three copies)
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# **System and Method for Time-Shifted Program Viewing**

### **1.0 Background of the invention.**

### 1.1 Broadcast. VCRs.

This invention is related to the field of broadcast television in all its forms. This includes but is not limited to over-the-air broadcast, cable TV, and satellite TV. The primary focus is the broadcast paradigm, whereby programs are scheduled by the broadcaster and broadcast in real-time whereupon viewers may tune in to the program. This invention relates in particular to a device which allows users much greater flexibility in their reception and use of this programming. VCRs are one example of an earlier technology that relates to the use of broadcast programs. Using VCRs, viewers were able to record a program and play it back at their leisure, perhaps at another time. Additionally, for the first time viewers were offered limited control over the viewing. The user could pause, rewind, fast-forward and stop and re-start viewing at any time after the initial recording was complete. The broadcast program was essentially captured in an analog medium for later use. Some of the limitations of a VCR which the present invention addresses are: simultaneous record and playback from the same medium are not available, the device records only one, or at the most two, channels at a time, and a removable medium, namely magnetic tape, is required.

This invention relates in a similar fashion to the broadcast television industry but offers new and unique features not found in VCRs or any other video/audio-programming-based device.

## 2.0 Objects of the Invention

The objects of the present invention include, but are not limited to the following. It is one object of the invention to facilitate recording of a program and allow viewing of the already-recorded material to take place while the program recording continues. It is another object of the invention to allow this simultaneous record/playback to take place on one or more channels simultaneously. It is another object of the invention to record using digital storage in many forms, using either internal or external mediums. It is another object of this invention to provide a 'save' function which incorporates semi-permanent digital storage of the recorded program as a function distinct from the simultaneous recording and playback of the program. It is another object of the invention to allow complete VCR-like control during playback. It is another object of this invention to allow the 'save' function to save edited versions of the program as defined by the playback commands used during viewing.

### **3.0 Summary of the Invention**

### 3.1 Overview

With the advent of digital video components, it is now possible to digitize, compress and store entire video programs using a variety of digital storage devices such as disk, digital tape, RAM, CD-ROM, DVD (Digital Versatile Disk or Digital Video Disk) and others. In the present invention, the system may be connected to a conventional video source such as broadcast TV, cable TV, satellite TV, VCR and so forth. In most cases, the video signal is in a standard RF-modulated analog format such as NTSC, PAL or SECAM. In the case of a modulated video source such as broadcast TV or cable TV, the signal is first demodulated to tune to a specific channel. This is performed by a conventional tuner such as those found in VCRs and TVs. The tuner may be used to tune into one or more channels simultaneously and more than one tuner may be included in the system. Digital inputs are also provided and will be described shortly. In the case of an incoming analog video signal, the signal is then digitized and optionally compressed using a conventional video capture board or video capture chip sets integrated into the system. This capture hardware accepts a video input, digitizes the video/audio program, optionally compresses the quantity of digital data and outputs a digital data stream which can be stored using any digital storage media. In variations of the preferred embodiment, the incoming video signal may already be in a digital format and thus not require digitization (such as a High-Definition Television (HDTV), Direct Broadcast Satellite (DBS) signal, or Internet-based broadcasts). Furthermore, the source digital signal or the digitized analog signal may or may not be compressed. The compression method used may vary and is of little consequence.

1 to the present invention, which can use uncompressed digital data or compressed data. However, the  
2 current common compressed digital formats include MPEG and AVI formats. For the present  
3 invention, the selection of the video capture board or chip sets (and the compressed digital format it  
4 uses) is relevant only to the quality of the video playback and the corresponding amount of digital  
5 storage required. It is envisioned that the embodiments will vary depending on the desired quality and  
6 cost constraints for the storage media. In a relatively inexpensive consumer device, for example, a  
7 cost-efficient MPEG-1 and inexpensive four-Gigabyte hard drive might currently be used. On the  
8 other hand, a professional application might currently use MPEG-2 and RAM for very high quality  
9 along with very fast access. An important consideration regarding the selection of the video capture  
10 board and the storage media is that the data rate for writing to the digital storage must exceed the  
11 output rate of the video capture hardware. For example, if MPEG-1 is the selected compression  
12 method and the output rate of the capture/compression hardware is therefore 1.5 Mbits/second, then  
13 the sustained data rate for writing to digital storage must be greater than 1.5 Mbits/second or else data  
14 will be lost. Also, compression/decompression may take place via software algorithms implemented  
15 by the system's main CPU or in dedicated compression/decompression processors. Cable converter  
16 boxes, commonly known as "set-top" boxes provide decoding of compressed digital video streams. In  
17 such a case one embodiment of the present invention includes a provision for using the set-top box for  
18 providing the compression/decompression for the system.

19

### 20 3.2 Dual-port circular buffer storage

21 A key aspect of the present invention is its use of FIFO dual-port storage. Digital storage systems are  
22 most commonly used in an off-line mode, that is, data is written and the data is read at some later  
23 time. For example, in a video compression and playback system, the compressed digital data would  
24 likely be written to disk during recording and, after the recording process has been completed, the  
25 data could be read for playback. In this sense, storage is used as an archive – even if the archive will  
26 be used moments later, the process of storing all the data must be completed before the data is used.  
27 In contrast, the present invention is designed to be dual-ported, that is, to be accessed for writing and  
28 reading simultaneously on the same media. In this manner, at any time after the process of capturing,  
29 optionally compressing and storage has begun, the program is also accessible for reading,  
30 decompression, playback and other functions. This can also occur while the recording process is  
31 continuing to store data using a separate and distinct section of the same storage medium.  
32 Additionally, the storage medium in the system is designed as a FIFO, which is a commonly-  
33 understood acronym in the art which stands for First In First Out. FIFO storage is essentially used as  
34 a circular buffer. The first data written into this circular buffer is the first data which is overwritten.  
35 For brevity, the terms 'buffer storage' or 'buffer' may be used herein, but the term always refers to  
36 this dual-port circular buffer storage unless otherwise noted.

37 In an example of the preferred embodiment, the use of this buffer storage is also taken a step further.  
38 In this embodiment, once the storage medium has been filled, the oldest data, which is the first data  
39 to have entered the FIFO, is pushed out – it is overwritten with the new data. In this manner, the  
40 buffer storage is constantly filled with the latest recorded material. The total amount of storage in the  
41 buffer determines the extants of VCR-like control for rewind and fast-forward. Alternatively, only a  
42 designated amount of the total storage may be used for recording, leaving storage available for other  
43 features of the system. In any case, this FIFO dual-port storage will be referred to herein as buffer  
44 storage. Buffer storage is always the storage used to provide direct access for the viewer to control  
45 playback of the recorded material.

46

### 47 3.3 Circular Buffer Example

48 In the example of the preferred embodiment, consider the scenario for 30 minutes of buffer storage  
49 and the viewer wishing to begin viewing of a two-hour program fifteen minutes after the scheduled  
50 broadcast start time of 8:00 p.m. At 8:00 p.m. the system begins recording the broadcast program.  
51 This may occur due to a timer previously set by the user or it may occur because the system is set to  
52 continuously record. Furthermore, the system may have been recording continuously for some time.  
53 However, in order to illustrate the nature of the dual-port circular buffer, in the present example we

1 consider the case where the present invention has just been turned on and the buffer has been initially  
2 empty.

3  
4 Recording of the broadcast program begins at 8:00 p.m. At 8:15 p.m. the user begins viewing the  
5 8:00 p.m. material. Simultaneously, the present invention continues to record the currently-broadcast  
6 8:15 material. At 8:30 the buffer storage is completely filled. Consequently, the oldest material,  
7 namely 8:00, is overwritten with the current 8:30 material. This process continues indefinitely, and  
8 effectively, the viewer has time-shifted their viewing by 15 minutes in the present example. (The user  
9 may time-shift up to the maximum buffer storage size configured in the system, which in the present  
10 example would be 30 minutes.)

11  
12 Because of the aforementioned 15-minute time-shift the viewer may now exercise VCR-like control  
13 features on the already-recorded material. So in the present example, the viewer could fast-forward  
14 past commercials or any objectionable material. Pause, stop and rewind features are also available,  
15 enabling the viewer to re-watch a segment or to pause the playback for a phone call or other  
16 interruption

17  
18 **3.4 Catching up to live broadcast**

19 If the viewer were to fast-forward through the full buffer of recorded material, they would be caught  
20 up to the live broadcast. When this occurs, the present invention may switch directly to the live feed  
21 without processing the input video through the usual capture and compression. In a further  
22 embodiment, even the input video stream (which is the 'live' feed) may be processed through capture  
23 and compression if so desired. Note that in such a scenario only pause and rewind features would be  
24 available because no material is available in the buffer for fast-forwarding.

25  
26 **3.5 Do-not-overwrite mode**

27 In one use of the present invention, the user may be watching video playback at the same rate at  
28 which new data is being recorded. Assuming that in the time between initiating recording and  
29 playback, the buffer storage has not already been filled up, it will in fact never get filled up because  
30 data is being removed at the same rate at which it is being added.

31 However, in another scenario, the user may not watch video playback at all during the recording  
32 process. In one embodiment of the present invention, the buffer storage is simply allowed to fill up  
33 and the recording process stops. In such an embodiment, it is the user's responsibility to recognize the  
34 limited amount of buffer storage in the system and use the system accordingly.

35  
36 Consider the embodiment whereby the system is designed to store two hours of video from one or  
37 more channels and is not set to overwrite any recorded data. In such a case, the recording process acts  
38 much like a conventional VCR – two hours of programming are recorded and when the storage media  
39 is filled, recording stops. However, the present invention, even in this particular embodiment has  
40 several unique advantages over a VCR. Programming viewing and control, by virtue of the digital  
41 data, is entirely random-access. The user may almost instantaneously skip to any desired portion of  
42 the program. Furthermore, even though the recording process stopped when storage was filled, once  
43 playback begins, the user may record new material while viewing the two hours of previously-  
44 recorded material

45  
46 **3.6 Partial summary of unique features**

47 The aforementioned features in essence return control of viewing to the viewer, who is no longer  
48 forced to view objectionable broadcast material or to adhere strictly to the broadcast schedules.  
49 Complete control is returned to the viewer, especially for real-time broadcasts. To achieve this  
50 control, the viewer need only slightly delay their viewing from the normally-scheduled broadcast start  
51 time. Once the present invention's FIFO dual-port storage has recorded some portion of the  
52 programming, the viewer has complete VCR-like control over the slightly-delayed but real-time  
53 broadcast, without having to wait for the entire program to be recorded.

1  
2       3.7 Multiple-channel device

3 To complete the paradigm shift into viewer-controlled broadcast television viewing, one embodiment  
4 of the present invention performs all of the aforementioned functions simultaneously on many  
5 channels. In this manner, the viewer may literally scan through, watch, or store one or more of the  
6 channels, with all of the aforementioned features. In such an embodiment, multiple video capture  
7 compression/decompression cards would be required, or cards that are designed to accommodate  
8 more than one video input stream. Multiple input streams may be realized through multiple tuners  
9 with multiple output streams to one or more storage devices or through a single tuner with multiple  
10 output streams to one or more storage devices. The total aggregate bandwidth of data to be stored  
11 might also require faster storage media. Certainly RAM-based systems could handle such bandwidths  
12 and write speeds. In a disk-based embodiment, high-speed disk drives such as RAID drives can  
13 accommodate the higher bandwidths. The total required bandwidth in any embodiment is determined  
14 by the output data rate of each video capture/compression card, chipset or software data stream. By  
15 varying the quality of the video, the compression method or the video resolution, the bandwidth may  
16 be adjusted to suit the application. In some cases, these and other parameters of the video  
17 capture/compression hardware or software are adjustable, thus allowing the output data rate to be  
18 adjusted. In other cases, this adjustment is made merely by the selection of the desired  
19 compression/decompression hardware or software versus another. In one embodiment this  
20 configurability is tied directly to the content provider. For example, certain movies may include a  
21 command which is recognized by the present invention and is used to set (at the user's discretion) the  
22 compression/decompression quality to a higher-than-usual level.

23  
24       3.8 Archival and 'Save' features

25 Another feature of the present invention is its ability to off-load the buffer storage onto other more  
26 permanent media for either internal or external archival. For example, a RAM-only embodiment may  
27 also be configured with one or more other digital storage devices, such as hard-disk or recordable  
28 DVD. At any time, even automatically during recording and/or playback, the contents of the buffer  
29 storage may be selectively or continuously transferred or duplicated to these archive storage devices in  
30 order to retain a copy of the program. In some embodiments, the viewer will transfer the program to  
31 removable media such as DVD disc in order for it to be used in another device, including another of  
32 the present invention. In this manner, viewers can build a 'library' of recorded material much like is  
33 currently accomplished with conventional VCRs. Such archival may occur at any time, including  
34 before, during or after the viewing of the stored material. In one embodiment, archival occurs as a  
35 user-selected transfer from the main storage to archival storage. In another embodiment programming  
36 is continuously recorded on the larger archival storage in addition to the main storage.

37  
38 The present invention, however, offers several additional advantages over the traditional analog-tape  
39 VCR library. First, due to the digital nature of the data, many different embodiments are envisioned  
40 utilizing different types of digital storage media. In some embodiments, multiple types of storage  
41 media may be used, offering different levels of off-line or on-line storage and allowing the user to  
42 account for the various cost and physical considerations of the stored media type. Archival storage  
43 may be implemented as distinct devices separate from the buffer storage or as an allocation of one  
44 large storage device, with one portion designated and used as buffer storage and another as archival  
45 storage.

46  
47 Another unique feature of the storage characteristics of the present invention is that the  
48 aforementioned archival functions may be initiated at any time including after the program has been  
49 viewed in its entirety from the buffer storage. For example, in a RAM-based embodiment, the user  
50 may elect to transfer the entire contents of the program from RAM to hard disk, while playback and  
51 recording continue, or the user may also elect to transfer after viewing from RAM is complete. The  
52 only caveat in this process is that the user must consider the overwriting, circular buffer nature of the  
53 buffer storage and that the oldest material is overwritten when the allocated amount of storage

1 becomes full. For this reason, this overwriting feature as well as all features of the system may be  
2 user-configurable. Other examples of archival storage mediums, both internal and external, include  
3 but are not limited to, hard disk, removable hard disk, tape, optical disk, DVD or any other digital  
4 storage medium

5

6

7 **3.9 Save-with-edits feature**

8 Another unique feature of the storage characteristics of the present invention is that the  
9 aforementioned archival functions may include interpretation of the playback control as edit events,  
10 thus modifying the copy of the program which is to be archived. For example, a user may record a TV  
11 movie, fast-forwarding past each commercial. Upon storing the viewed program, the user may elect  
12 to interpret the fast-forwarding or similar control in several ways. First, it may be taken literally, with  
13 the archived program including a control code for 'fast-forward'. Upon playback, this control could  
14 be interpreted and executed by the playback control software, thereby resulting in the playback of the  
15 program exactly as the viewer watched it, fast-forwards and all. A second manner of interpreting the  
16 fast-forward could be as an edit point, the implication being that since the user fast-forwarded past a  
17 portion of the program they did not want to view it and therefore that portion of the program need not  
18 be archived at all. In such a mode, upon playback the video would seamlessly skip past the fast-  
19 forwarded portion of the program since it was not recorded in the archive at all. And in a third  
20 manner of interpreting the fast-forward or other playback controls, these controls may not be recorded  
21 in archive at all, i.e. they may be ignored, implying that the user desires to have brand-new control  
22 over the video at playback time

23

24 **3.10 Demographic and viewing habits data collection**

25 A further feature of the present invention is that all of the aforementioned VCR-like control features  
26 may be stored as data representing the viewer control. In other words, all of the viewer control such  
27 as fast-forward, play and pause are captured as data. This viewer control data may be used in a  
28 number of ways, including storage along with the archived program as described previously. In  
29 another embodiment of the present invention, a modem is provided for communication to other  
30 similar devices or to computers via network communication channels, such as phone lines, cable  
31 modems, and satellite. In such an embodiment, at the election of the viewer, the viewer control data  
32 may be provided to a central computer for storage. The data may later be analyzed by advertisers,  
33 broadcasters, ratings companies and so forth to receive indirect feedback from viewers regarding  
34 viewing preferences. This same communication channel may be used to transmit software upgrades to  
35 the invention, remote diagnostics, billing data or pay-per-view locking/unlocking by the content  
36 provider. In another embodiment, the modem may be replaced by a faster communications device  
37 such as a satellite receiver, Internet connection or so forth.

38

39 **3.11 Network-controlled configurability**

40 The aforementioned network communication channels are also used in another unique way. Since  
41 these channels provide a link to other computers, possibly on the Internet, this connection may be  
42 used to automatically set the configuration of the system from these computers. For example, in an  
43 embodiment connected to the Internet, the system also includes basic computer components sufficient  
44 to interact with the World-Wide Web. Besides the network communications channel the system also  
45 includes a video graphics card and one or more user-interface devices which may include but are not  
46 limited to: a mouse, touchpad, keyboard, trackball, remote control or voice control. With this Web-  
47 based connection, content providers or third parties may link Web pages to interact with the present  
48 invention. For example, a third party may offer pay-per-view programs, wherein the program may be  
49 ordered via the Web, and data provided via the Web so the present invention can set parameters such  
50 as record timers, video quality settings, channel tuning and so forth. The Web site may provide  
51 additional data about the offered program to aid the users in selecting programs, such as plot  
52 summaries, ratings, casts and so forth.

53

1 Many of the aforementioned features may be implemented in various modes and in some cases  
2 selectable by the user to be automatic. For example, "continuous recording" may be a mode, whereby  
3 the preferred embodiment continuously records on one or more programming channels, overwriting  
4 the oldest data as previously described. But this mode is selectable for there might be situations where  
5 this is not desirable, such as setting a timer on the present invention to record a program at a specific  
6 time. Should the user arrive home much later than expected, the recorded program is still available,  
7 instead of being recorded over by the latest program. And as another example, the aforementioned  
8 editing capabilities are configurable by the user, such as the "archive as edited" mode, in which  
9 control functions dictate an edited form of the program for archival. These functions and configurable  
10 options are all controlled through any one of several user-interface methods. In one embodiment, a  
11 remote control and on-screen menus are used. In another embodiment, buttons on the device are used,  
12 also in conjunction with on-screen menus. These and other user-interfaces are implemented alone or  
13 in combination, thus providing access to all of the unique features described herein.

### Detailed Description of the Preferred Embodiment

Fig 1 – underlying context of functional advantages, example one  
Fig 2 – underlying context of functional advantages, example two  
Fig 3 – operational overview  
Fig 4 – block diagram

Figure 1 illustrates the underlying context of the operation of the present invention. Timeline 130 is depicted illustrating a particular example from 8:00 to 10:00. Of course the times and durations of this example are for illustrative purposes only and any time or duration may be used. Random access viewing position 100 represents the current location within the recorded buffer from which viewing is taking place. Buffer storage 110 illustrates the use of a 30-minute buffer and once again, this is for illustrative purposes only and any duration may be used. Similarly, archive storage 120 illustrates archive storage of over two hours of recorded material. In the example of figure 1, assume the viewer wishes to time-shift their viewing by 15 minutes. With recorded material illustrated as gray-shaded, Figure 1 shows the case at 8:15, whereby half of buffer storage 110 has been filled with recorded material from 8:00 to 8:15. Only half the buffer is filled in this example because this figure depicts the situation soon after present invention was initially turned on. Once the buffer fills up it acts as a circular buffer, as described previously. The underlying context shown in Figure 1 corresponds with the example set forth in section 3.3.

As depicted for buffer storage 110, within this buffer the user has complete VCR-like control such as rewind and fast-forward. So the viewer may begin playback of the 8:00 material and immediately has the capability to fast-forward up to the contents of the current buffer which in the illustrative example is 8:15. Archive storage 120 maintains an archived copy of all the recorded material.

Figure 1 is used to illustrate the use of buffer storage 100 and its relationship to the current time. Recording continues simultaneously during any of these operations, continuing at the position of the current real time as depicted in the figure.

The unique functional advantages of the invention are shown in Figure 2. This example depicts the situation at 9:00. In this case, buffer storage 210 is now filled with material which was recorded from 8:30 until 9:00 and the viewer has full VCR-like control over this range of time. All components of this figure, timeline 230 random access viewing position 200, buffer storage 210, archive and storage 220 are functionally equivalent to the corresponding elements of Figure 1. Figure 2 simply illustrates the conceptual use of the buffer storage at a later time than that of Figure 1. Also, the buffer storage and

1 archive storage of both Figures 1 and 2 correspond directly to the storage in the block diagrams in Figures  
2 3 and 4

3  
4 Figure 3 illustrates the operational overview of the preferred embodiment. Analog input video source 300  
5 is connected to capture/compression card 320 which includes capture/compression hardware 330 and  
6 decompression playback hardware 340. Storage input connection 340 illustrates the writing of the  
7 compressed program data to storage device 380. Storage device 380 corresponds to the aforementioned  
8 buffer storage and may also be used as archival storage.

9  
10 For playback, storage output connection 350 transfers data from storage device 380 to  
11 decompression/playback hardware 360. During playback, via video out connection 310, the program is  
12 transferred to a standard video device (not shown) such as a TV, monitor or VCR. Recording direction  
13 arrow 370 is included to conceptually illustrate the use of storage 380 as a circular buffer as explained  
14 previously

15  
16 Figure 4 depicts a block diagram of the preferred embodiment. Housing 400 is an enclosure for the present  
17 invention, including necessary power supplies, casing, fans, buttons, power cord and connectors. These  
18 components are not depicted but are well-understood in the design and manufacture of consumer (or  
19 professional-grade) electronics. Contained within this housing in addition to the aforementioned basic  
20 components are: CPU 530, capture/display hardware 500, compression/decompression hardware 480,,  
21 output display switch 470, network interface 550, I/O controller 570, system RAM 560, system bus 510,  
22 storage 580, removable storage 590, set-top-box switch 424, tuner bypass switch 426, capture bypass  
23 switch 460, and input monitor switch 428. Also depicted but not included as part of the present  
24 embodiment are external components set-top box 410, content provider 420, television 430, monitor 340,  
25 VCR 450, telecommunications connection 520, telecommunications cloud 490, workstation 595 and set-  
26 top box bypass switch 422.

27  
28 Content provider 420 comprises, without limitation, over-the-air television broadcasters, cable TV  
29 operators, satellite-feed providers and direct broadcast satellite (DBS) broadcasters. In some cases, the  
30 program material is made accessible to the user via set-top box 410 instead of directly from content  
31 provider 420. Set-top box 410 may be a common cable converter box or a digital video and user-interface  
32 box as used in upcoming cable and satellite services. The video format provided by both set-top box 410  
33 and content provider 420 is most often a standard analog video signal and is routed to capture/display  
34 hardware 500. However, in some cases a digital video signal is provided and therefore the capture  
35 (analog-to-digital conversion) ordinarily provided by capture/display hardware 500 is not needed. Capture  
36 input switch 560 is provided for such a circumstance and the input digital video is routed directly to  
37 compressor/decompressor 480. This switching may be automatic by the system, automatically controlled  
38 by the content provider or set-top box or it may be user-selectable

39  
40 In the case of an analog video input signal, the program must first be converted to a digital format.  
41 Capture/display hardware 500 is a video capture and playback card. Alternatively, this may be  
42 implemented in a chipset form and integrated onto the main circuit board of the system. Capture/display  
43 boards are well-known in the art. Current examples include hardware MPEG capture/compression boards  
44 commonly used in computer systems. Such boards often integrate the compression element of the present  
45 invention, compressor/decompressor 480, into the same board for a full capture, compression,  
46 decompression and playback functionality. Such components may be used in the present invention to  
47 implement both capture/display hardware 500 and compressor/decompressor 480. Alternatively, separate  
48 boards may be used. However, any of the capture, compression, decompression and display elements may  
49 be incorporated directly onto the main circuit board of the invention.

50  
51 The capture and compression of the incoming video program, or the automatic or user-selectable  
52 switching out of the capture element, are all managed under control of CPU 530 which is a conventional  
53 microprocessor. Software running on CPU 530 manages the capture, compression and storage of the  
54 program. In doing so, it controls system bus 510, to which all major components are connected. In this

1 manner, CPU 530 controls the I/O controller, which in turn is used to operate storage 580 and removable  
2 storage 590 Storage 580 may be implemented by one or more digital storage devices for buffer storage  
3 and/or archive storage as discussed previously. System RAM 560 is used as needed by the system for  
4 software execution and temporary data storage. The software controlling capture/display 500 and  
5 compressor/decompressor 480 may use this as buffer memory. In another embodiment,  
6 compressor/decompressor 480 may be eliminated entirely, with CPU 530 performing the  
7 compression/decompression operations in software, in which case compressor/decompressor 480 uses  
8 system RAM 560 as buffer memory for such operations In a similar embodiment,  
9 compressor/decompressor 480 may be eliminated with set-top box 410 performing  
10 compression/decompression. And in yet another embodiment, compressor/decompressor 480 and  
11 capture/display 500 may both be eliminated, with all of these functions being performed by set-top box  
12 410

13  
14 Storage 580 is implemented as any type of digital storage media. This includes, without limitation,  
15 internal or external versions of hard disk, optical disk, DVD, magnetic tape and semi-conductor storage  
16 Similar storage solutions may be implemented for removable media 590 Although only one storage  
17 device is depicted, more than one may be used.

18  
19 Network interface 550 connects the device through network connection 520 to telecommunications cloud  
20 490 Telecommunications "cloud" is a term commonly used to denote a myriad of inter-connected  
21 telecommunications connection types and interfaces. It is essentially a superset of the Internet and may  
22 include networked computers, telephone lines, and other telephone company equipment such as satellite,  
23 microwave and so forth The portion of telecommunications cloud 490 to which the present invention is  
24 connected determines the type of network connection 520 and network interface 550 For example, in a  
25 home-based embodiment, network interface 550 is likely to be a modem and telecommunications  
26 connection would be a telephone line Other examples include, without limitation, cable modems and  
27 cable networks, computer networks such as Ethernet and their associated interfaces, and satellite modems.  
28 The present invention is operatively connected through telecommunications cloud 490 to workstation 595  
29 Workstation 595 is any type of computer used by advertisers, broadcasters, ratings companies and so forth  
30 to receive indirect feedback from viewers regarding viewing preferences Data about the user's viewing  
31 habits and use of the invention may, at the user's option, be transmitted via network interface 550 through  
32 the aforementioned operative link to workstation 595.

33  
34 Many options are available for implementing the simultaneous read and write of storage 580 Commonly-  
35 available hard disks may be used, depending on the data rate of the compressed data stream of the  
36 capture/compression hardware For example, if MPEG-1 video is used, one stream requires a data rate of  
37 1.5 Mbits/sec Therefore, to simultaneously read and write, storage 580 must be capable of sufficient  
38 throughput for one write stream and one read stream, totaling 3.0 Mbits/sec Such input/output speeds are  
39 well within the realm of current hard drives, which can sustain data rates of over 10 Mbits/sec.

40  
41 Other embodiments can use other solutions for storage 580. For example, some embodiments will record  
42 many channels simultaneously and may even play back more than one channel simultaneously to provide  
43 a 'picture-in-picture' feature similar to current televisions. The total required bandwidth may exceed the  
44 sustained data rates for conventional disk drives. In such a case RAID (Redundant Array of Inexpensive  
45 Disks) systems may be used. These systems are disk array subsystems which use several disk drives in  
46 parallel to achieve faster overall throughput. Similarly, the present invention may simply incorporate  
47 individual drives for each tuned channel RAM and other high-bandwidth storage solutions may be also be  
48 used.

49  
50 The ultimate use of the recorded data is in the playback. As the user views programming through all the  
51 aforementioned features, the data is read from storage 580 or from removable media 590 This compressed  
52 data is routed to compressor/decompressor 480 for decompression under control of CPU530. In some  
53 embodiments, the data may be in an uncompressed form and compressor/decompressor 480 may be  
54 bypassed. Once the data is uncompressed, it may be routed directly to monitor 440 for viewing on a digital

1 monitor such as those used by computer systems. Set-top box 410 and/or television 430 may also be  
2 capable of accepting digital data in either a compressed or uncompressed form and consequently data may  
3 be routed there directly. In the preferred embodiment, the uncompressed digital data is routed to  
4 capture/display 500 for conversion to an NTSC, PAL, SECAM or other standard video signal for viewing  
5 on one or more of the display devices, TV 430, monitor 440 or VCR 450

6

7

8 What is claimed is

9

10 1 A method for time-shifted viewing of broadcast audio/video programs comprising:  
11 the step of receiving one or more broadcast video/audio programs; and  
12 the step of storing said programs as data in a cyclic buffer wherein upon being filled said cyclic  
13 buffer begins replacing the oldest of said data with the newest of said data, and  
14 the step of providing simultaneous playback control of said data independently from said step of  
15 storing said programs wherein said playback control comprises random access play, stop, pause, rewind  
16 and fast-forward functions,  
17 whereby said time-shifted viewing is selectively delayed relative to initiation of said broadcast  
18 audio/video programs and which may be initiated and controlled simultaneously with said storing of said  
19 programs.

20

21 2. A method as in claim 1 further comprising:  
22 the step of moving said program data from the cyclic buffer to one or more storage devices for  
23 archival of said program data.  
24 wherein said one or more storage devices are used for selective retrieval, playback and control of  
25 said programs

26

27 3. A method as in claim 2 further comprising  
28 the step of storing data representing user-control of playback of said programs on one or more  
29 storage devices.  
30 wherein said user-control playback data is stored for later use

31

32 4. A method as in claim 3 further comprising:  
33 the step of transmitting said user-control playback data to one or more receivers;  
34 wherein said user-control playback data is processed externally from the present system.

35

36 5. A method as in claim 1 further comprising:  
37 the step of receiving broadcast program configuration data;  
38 wherein said broadcast program configuration data is used for system configuration for one or  
39 more particular broadcast programs

40

41 6. A system for time-shifted viewing of broadcast audio/video programs comprising  
42 video input means for receiving one or more broadcast video/audio programs, and  
43 cyclic buffer means for storing said programs as program data in a cyclical fashion wherein upon  
44 being filled, said cyclic buffer begins replacing the oldest data with the newest of said data and is  
45 operable for simultaneous reading and writing of the said data; and  
46 viewing playback means for providing playback control of said data independently from the  
47 storing of said programs wherein said playback control comprises random access playback, stop, pause,  
48 rewind and fast-forward functions;

49 whereby said time-shifted viewing is selectively delayed relative to initiation of said broadcast  
50 audio/video programs and which may be initiated and controlled simultaneously with said storing of said  
51 programs

52

53 7. A system as in claim 6 further comprising:  
54 archive means for semi-permanent storage of said program data;

1        whereby said archive means is used as a save function for selective retrieval, playback and  
2        control of program data  
3  
4        8        A system as in claim 7 further comprising  
5            viewer playback control capture means for the capture and storage of user playback control data.  
6            whereby said viewer playback control data is stored on said archive means.  
7  
8        9.      A system as in claim 8 further comprising:  
9            data transmission means for transmitting said viewer playback control data away from said  
10          system;  
11            wherein said viewer playback control data is analyzed externally from said system.  
12        10      A system as in claim 9 further comprising  
13            data reception means for receiving broadcast program configuration data;  
14            wherein said broadcast program configuration data is operative for configuration of system  
15          options of said system for the recording of one or more broadcast programs  
16  
17

1      **ABSTRACT**  
2

3      A system and method for time-shifted viewing of broadcast television programs is disclosed. Simultaneous  
4      recording and playback are provided by using buffer storage as the source and destination of compressed  
5      or uncompressed digital video/audio programs. Full VCR-like control is provided for all playback within  
6      the buffer storage. Playback and control of recorded programs may be initiated by the user at any time  
7      after initiation of the broadcast program with simultaneous continuous recording of the ongoing live  
8      broadcast. Larger archival storage and removable is also provided for storing and building a library of  
9      programs. Viewer playback control data may be stored as part of the program or used as edit points prior  
10     to archival. Numerous options are provided for features such as continuous automatic recording in a  
11     circular buffer fashion, program archival, editing, Internet interfaces, multiple-channel recording and  
12     more.  
13

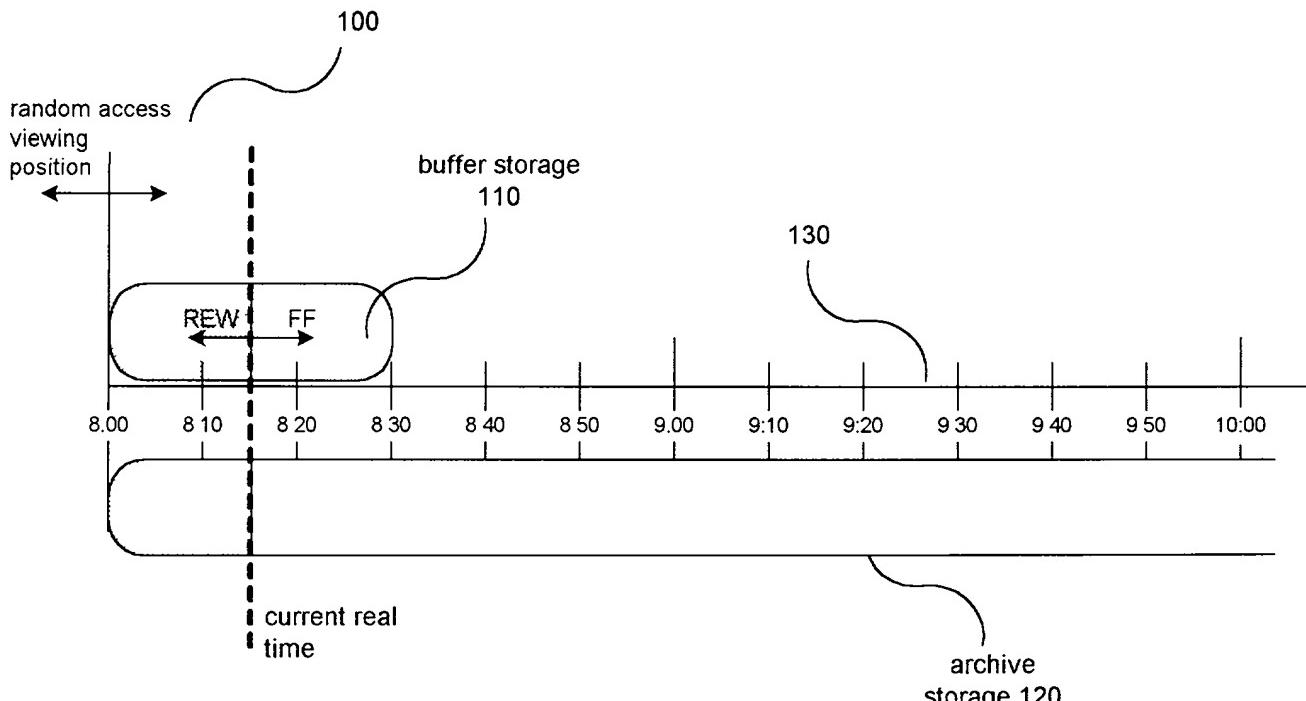


Figure 1

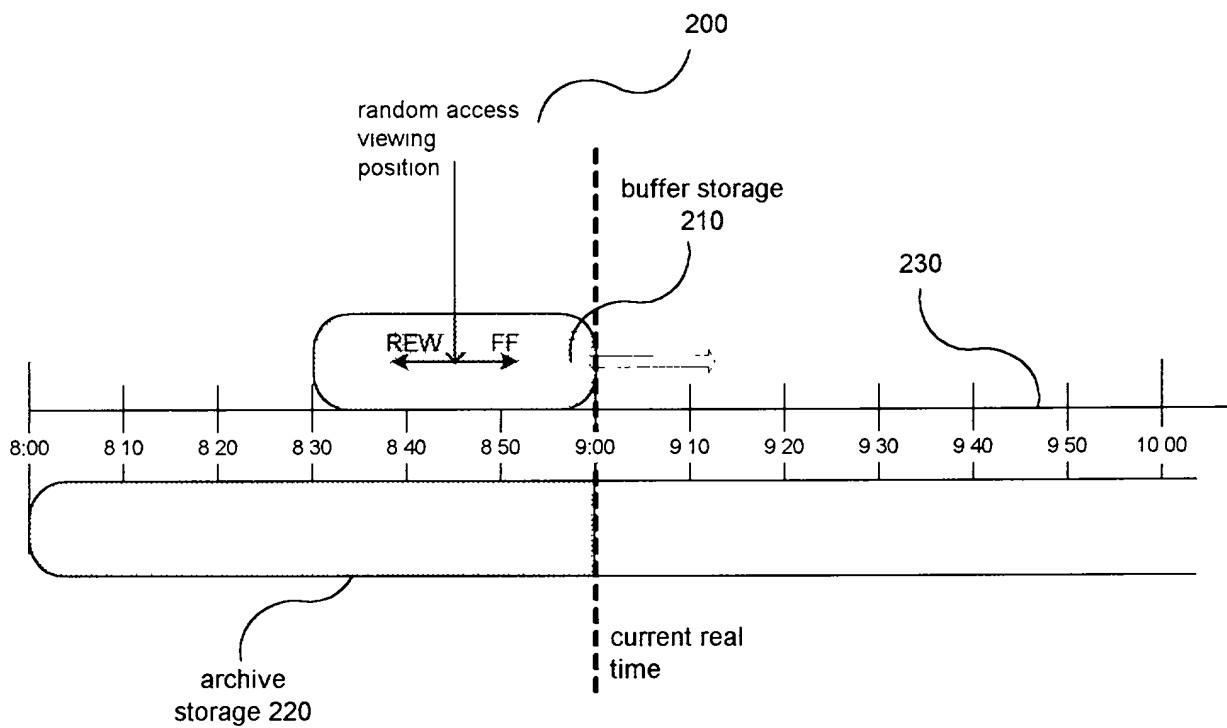


Figure 2

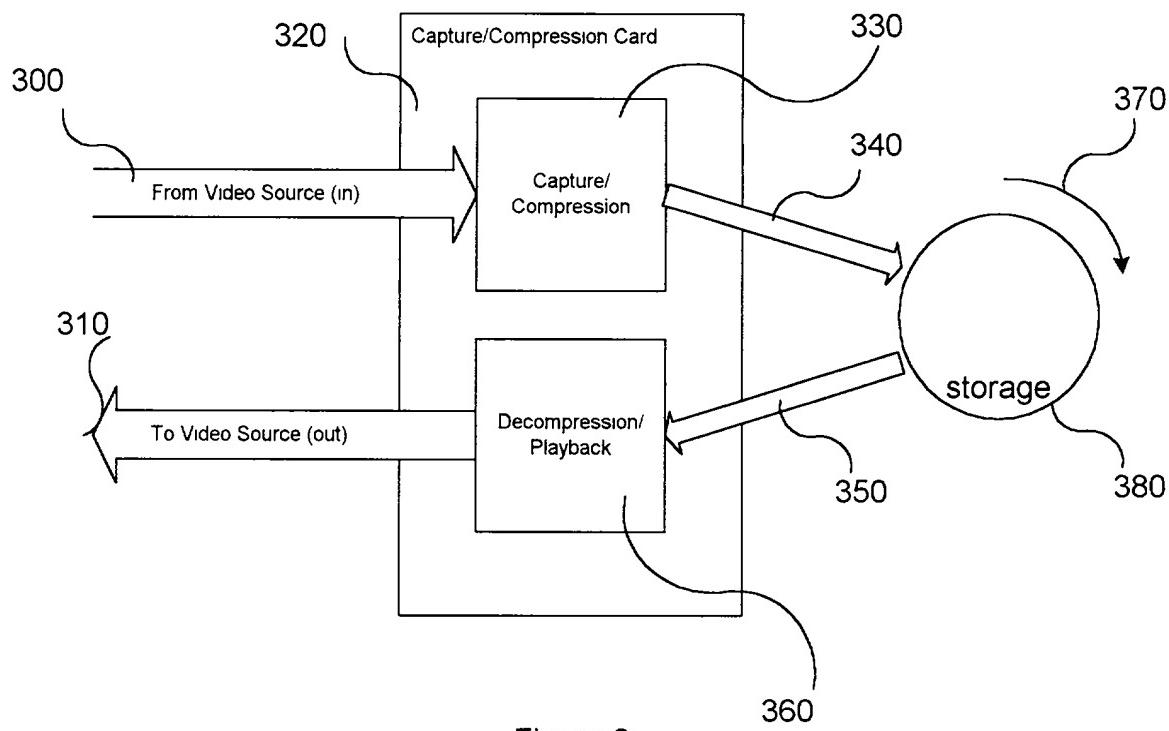


Figure 3

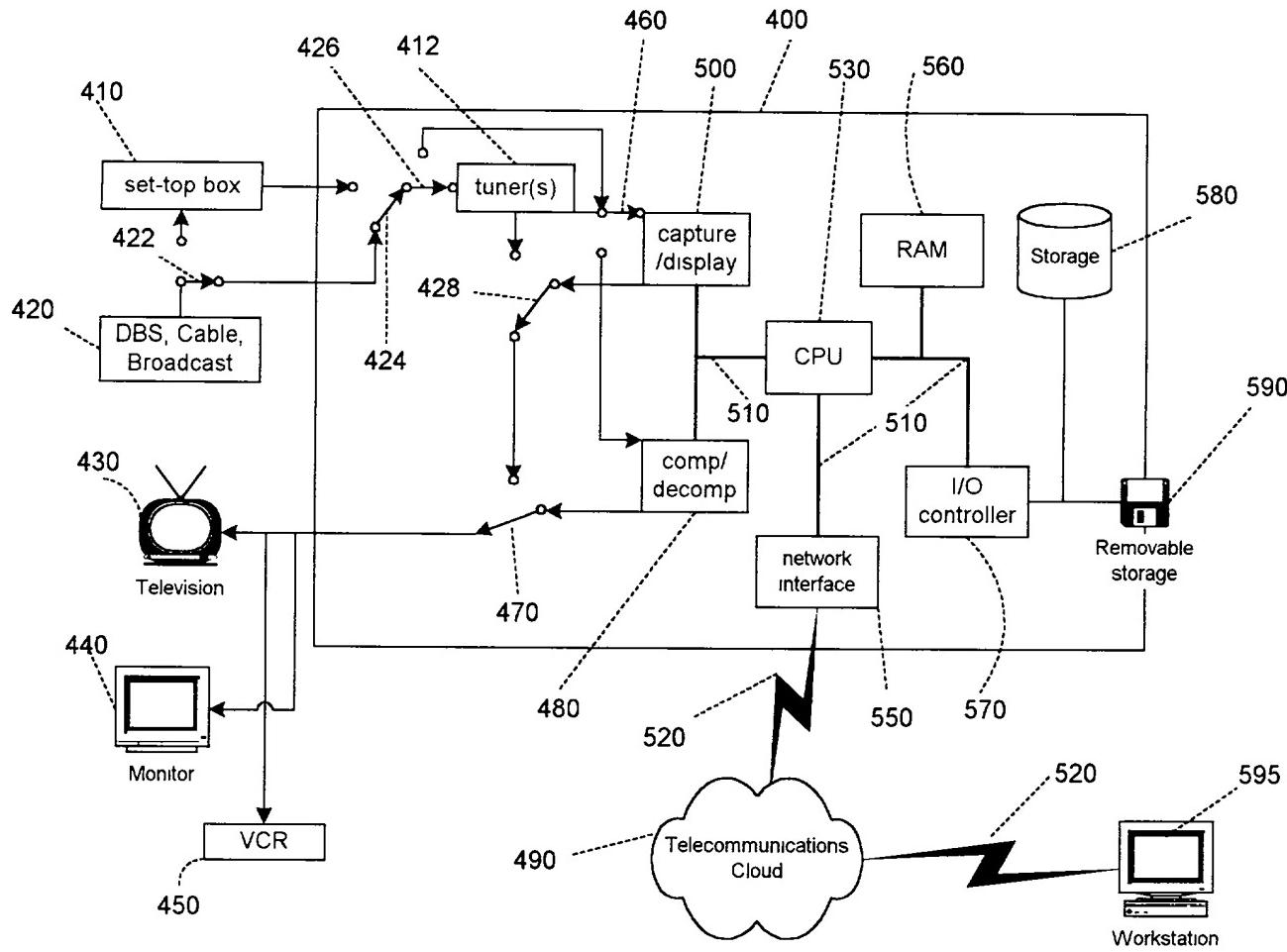


Figure 4

## **Declaration and Power of Attorney**

As a below-named inventor of the invention claimed in the attached application for United States Letter Patent, I hereby declare that:

### **Inventorship Identification**

My residence, post office address and citizenship are as stated at the end of this declaration next to my name; I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the invention which is claimed in the attached application entitled:

- > System and Method for Time-Shifted Program Viewing

### **Inventorship Claim**

I do not know and do not believe that this invention was ever known or used in the United States of America before my or our invention thereof, or patented or described in any printed publication in any country before my or our invention thereof or more than one year prior to this application, that this invention was not in public use or on sale more than one year prior to this application, that this invention has not been patented or made the subject of an inventor's certificate issued before the date of this application in any country foreign to the United States of America on an application filed by me or my legal representatives or assigns more than twelve months prior to this application, and that no application for patent or inventor's certificate on this invention has been filed in any country foreign to the United States of America prior to this application by me or my legal representatives or assigns, except as follows:

- > None

### **Acknowledgment of Review of Papers and Duty of Disclosure**

I have reviewed and understand the contents of the attached application, and acknowledge my duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, Section 1.56(a);

### **Priority Claim**

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119 of any foreign application(s) for patent or inventor's certificate, or of any PCT international application(s) designating at least one country other than the United States of America, filed by me on the same subject matter as set forth in the attached application, namely:

- > None

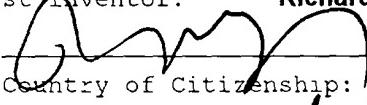
### Power of Attorney

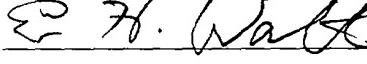
As a named inventor, I hereby appoint Earl I. Mincer, Registration number 36,396, 1118 E Rowlands, Phoenix, AZ 85022, (602) 789-7432, to prosecute this application and to transact all business in the United States Patent and Trademark Office connected therewith.

### Declaration

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements are made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

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